



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(54) Title:</b> AEROSOL INSECTICIDE COMPOSITION  <b>(57) Abstract</b>  <p>An aerosol insecticidal composition suitable for use on an aircraft, which comprises a dispensing container having aerosol dispensing means, and containing an insecticidal active ingredient, and optionally a solvent for the active ingredient, and a propellant gas at sufficient pressure to dispense the active ingredient from the dispensing means as an aerosol, characterised in that the propellant is chosen from any one or more of CF<sub>3</sub>CH<sub>2</sub>F, DME, CO<sub>2</sub>, or NO<sub>2</sub> and the solvent (if present) is chosen from any one or more of hydrocarbon, alcohol or water. Preferably the aerosol insecticidal composition is one wherein the propellant is CF<sub>3</sub>CH<sub>2</sub>F and the solvent is a hydrocarbon, and most preferably the aerosol insecticidal composition has the following composition: phenothrin 20:80 2 % by weight; permethrin 25:75 2 % by weight; petroleum solvent 8 % by weight; propellant - HFC 134a 88 % by weight or alternatively: phenothrin or permethrin 2 % by weight; petroleum solvent 10 % by weight; propellant - HFC 134a 88 % by weight. A method of disinsecting aircraft is also described.</p>		

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### AEROSOL INSECTICIDE COMPOSITION

The present invention concerns an aerosol insecticide composition which is particularly suitable for use on aircraft. Many countries have quarantine regulations which require incoming or outgoing aircraft to be treated with an aerosol insecticide. This is to prevent the spread of unwanted insects or of human, veterinary and agricultural vector-borne diseases around the world, and into countries like Australia where such diseases can do great harm.

In the past, suitable standard aerosols which are allowed to be used for aircraft disinsection have been recommended by a World Health Organisation (WHO) committee. Suitable aerosols include the active ingredients of resmethrin, bioresmethrin, phenothrin and permethrin. These are dispensed from a pressurised container by means of the inclusion of an aerosol propellant. These propellants have traditionally been chlorofluorocarbons (CFCs). Commonly used propellants are 1:1 mixtures of dichlorodifluoromethane (Freon 11), and trichlorofluoromethane (Freon 12).

However increasingly there are problems in using CFCs as aerosol propellants, on environmental grounds, due to the damage they cause to the earth's ozone layer. However, the use of alternate propellants to CFCs has not yet occurred in connection with aerosol insecticide propellants for use on aircraft. Alternate propellants such as propane or butane gas cannot be used on aircraft due to the possibility of explosion because of the gas's flammability. Other special requirements are needed for propellants for use on aircraft, and in addition to non-inflammability, to meet standards set by I.A.T.A., the substance cannot have a damaging effect on the plastics or metals used in the aircraft. In addition, the aerosol insecticide should meet the WHO standard for aircraft disinsection.

Also, for a considerable period Australian quarantine authorities have required that the holds and cabins of international aircraft arriving in Australia are disinfected to reduce the risk of introducing insect vectors of human and animal diseases and insect pests of plants. Over the years there have been various techniques, and different insecticide formulations used to achieve effective treatments, using as a general guide, the World Health Organisation (WHO) recommendations for the Disinsection of Aircraft. These recommendations allow for the treatment of aircraft using aerosol formulations either at the last port before entering a country or after arrival in the country. Residual treatment of aircraft cabin and hold surfaces has also been recommended as a treatment by WHO.

As part of a review of aircraft disinsection procedures during 1987 the Australian Quarantine and Inspection Service (AQIS) developed a procedure for the pre-departure disinsection of the cargo holds of aircraft at the last port before entering Australia using an aerosol formulation of d-phenothrin and permethrin. This formulation uses as the propellant a mixture of freon 11 and 12 (1:1). The aerosol is discharged in the holds by ground crew before loading the last cargo module into the holds and closing the cargo door. On Qantas aircraft the aerosol can be applied by an automatic device mounted to the cargo hold door.

The international action coordinated under the United Nations Environment Program (UNEP) has identified CFCs as major components in ozone depletion and a phase-out of their uses is being implemented internationally. The use of CFCs for aircraft disinsections is currently permitted because of the lack of suitable alternatives.

It is therefore an object of the present invention to provide an aerosol insecticidal composition which is suitable for use on aircraft, and which overcomes the problems inherent in prior art aerosols designed for this

purpose, and which avoids the use of CFCs as propellant gases. It has been difficult to find such an aerosol system, until the present invention.

The present invention therefore provides an aerosol insecticidal composition suitable for use on aircraft, which comprises a dispensing container having aerosol dispensing means, and containing an insecticidal active ingredient, optionally a solvent for the active ingredient, and a propellant gas at a sufficient pressure to dispense the active ingredient from the dispensing means as an aerosol, characterised in that the solvent (if present) is chosen from any one or more of an alcohol, water, or a hydrocarbon such as kerosene, and the propellant is chosen from any one or more of  $\text{CF}_3\text{CH}_2\text{F}$ , DME,  $\text{CO}_2$ , or  $\text{NO}_2$ .

One preferred embodiment of the invention concerns the aerosol insecticidal composition where the solvent (if used) can be selected from hydrocarbons such as kerosene, and the propellant is  $\text{CF}_3\text{CH}_2\text{F}$ . The preferred  $\text{CF}_3\text{CH}_2\text{F}$  propellant is HFC 134a (1,1,1,2-tetra-fluoroethane).

Alternatively, the propellant maybe a mixture of DME and either  $\text{CO}_2$  or  $\text{NO}_2$ . Otherwise a solvent such as an alcohol and/or water may be used with  $\text{CO}_2$  as the propellant. As a further alternative the solvent can be a mixture of alcohol and water together with DME and  $\text{CO}_2$  as the propellant.

As a further preferred embodiment, propellants such as  $\text{CO}_2$  or  $\text{NO}_2$  can be used in conjunction with  $\text{CF}_3\text{CH}_2\text{F}$ .

Preferably the insecticidal composition should meet WHO standards. These standards can be obtained from WHO Weekly Epidem. Rec. (7) 1985 pp.45-47 entitled, "Recommendations on the disinsecting of aircraft". In summary, these recommendations require that the dispenser should discharge

the formulation as an aerosol at the rate of  $1.0 \pm 0.2$ g per second, and the aerosol produced must comply with various physical requirements; for example, not more than 20% by weight of the aerosol should consist of droplets of a diameter greater than 30 micron and not more than 1% by weight of the aerosol should consist of droplets of a diameter greater than 50 micron. The insecticidal activity of the aerosol produced from its dispenser cannot be inferior to that of the standard reference aerosol having the following formulation:

- trichlorofluoromethane 42.5%
- pyrethrum extract (25% pyrethrins) 1.6%
- DDT technical 3.0%
- xylene 7.5%
- odourless petroleum distillate 2.9%
- diclorodifluoromethane 42.5%

The amounts are shown as percentages by weight.

It is highly desirable that the formulation should cause no residual risk to the aircraft structure or operating equipment, and for there to be no risk of fire. Therefore a very low flammability, and a suitable inertness of the composition is highly desirable. Of course, the insecticide used should not be dangerous to humans.

The insecticide will normally be in a standard dispensing container of the type already used for aircraft. As well as disinsecting the aircraft cabin, the baggage and cargo holds should also be treated. This is often done by the pilot releasing the insecticide in a one-shot container, by remote control, on landing, or before taking off, whereby the insecticide is spread throughout the cargo hold of the aircraft. The insecticide may be released in the passenger cabin either manually by airline stewards spraying the insecticide, or by remote control into the air conditioning system in the aircraft cabin.

Suitable insecticides include resmethrin, bioresmethrin, d-phenothrin and/or permethrin (25:75 cis/trans ratio). A suitable mixture of insecticides is permethrin (25:75) in an amount of 2% by weight and d-phenothrin (20:80), also in an amount of 2% by weight. Otherwise each of the preferred insecticides; permethrin (25:75), or d-phenothrin (20:80), may be used alone. These insecticides are available from Roussel Uclaf, for example.

The remainder of the contents of the dispensing container will comprise mostly propellant, but may also contain an amount of solvent to dissolve the insecticide, and allow it to be easily dispensed as an aerosol. The presence of a solvent also assists to ensure that all the active ingredient is dispensed from the container into the aircraft, and to assist the insecticidal activity of the active ingredients.

The formulation for cargo holds will normally contain 4% of the two preferred active ingredients, and 8% of solvent. The formulation for use in the passenger compartment will normally contain a single active ingredient in an amount of 2%, and 10% of solvent.

One preferred form of the invention involves the use of HCF 134a as the propellant gas with a paraffinic hydrocarbon such as kerosene ("Exxsol"), isoparaffins ("Isopar") or normal paraffins ("Norpar") as a solvent; a preferred such solvent being "Exxsol D80" or one selected from Isopar, white spirit and the like. These solvents are available from Exxon Chemicals, for example. The solvent should be present in an amount of less than about 12% (by weight), ideally about 8% to 10%. If 4% by weight of the composition is active insecticidal ingredients, then the 134a propellant can be present in an amount of about 88% by weight. The container is then pressurised, to a pressure of about 100 psi. The minimum pressure in the can should be at least 60

psi, at normal pressures. The can should withstand the change in outside pressures normal to aircraft operations.

The dispensing container is preferably an aluminium monoblock can. The dispensing means can be a one-shot type, whereby on activation the complete contents of the can are expelled. Alternatively, the dispensing means can allow a limited amount of the aerosol to be expelled at a time. A combination of one shot and controllable dispensing is also allowed in accordance with the invention. The can may be lined, if desired, with a lining to prevent corrosion, and leakage. The ingredients may be added to the container in any appropriate order, in accordance with usual practice in producing aerosol products. Any suitable size may be used, but a can of a suitable dimension to be usable in existing release mechanisms that are installed on aircraft is preferred. Cans of 75g and 150g (filled) are suitable, for instance.

Further ingredients may be added to the formulation, in small quantities, if desired. Such ingredients include corrosion inhibitors, pH buffers, perfume, and so on. Suitable such ingredients chosen from the prior art may be used in this instance.

Ideally, the aerosol composition contains 4% active ingredient, an amount of paraffinic hydrocarbon solvent for the active ingredient(s), such as deodorised kerosene, in an amount of up to about 8% by weight, and as a propellant gas, 134a, (1,1,1,2-tetra-fluoroethane). Alternatively, the composition may contain 2% of a single active ingredient and 10% of solvent. 134a is a propellant which does not have the environmental dangers previously known for CFCs, and is therefore advantageously used for dispensing aerosols in aircraft.



In addition, the present invention concerns aerosol compositions for use other than in aircraft, but which advantageously share the same requirements with aerosols used in aircraft. For example, such aerosols can be used in the home as one-shot aerosols for dispensing insecticide throughout a room, when the human inhabitants are not present. For example, the aerosol composition with 134a as the propellant may be used with methoprene as the active insecticidal ingredient, as a one-shot process for treating homes or rooms for dust-mites. Also, personal insecticidal compositions for spraying directly on human skin can utilize the compositions of the present invention.

The invention also involves a method of de-insecting aircraft which comprises spraying the cargo holds and/or passenger compartments with an aerosol insecticidal composition referred to above immediately before departure and/or before arrival of said aircraft at an airport.

The invention is now described as reference to various examples, which are not intended to be limiting on the invention in any way.

#### Example 1a

An aerosol formulation is prepared comprising 2% d-phenothrin and 2% permethrin. An amount of 34% DME is added to the formulation, as well as 2% of a corrosion inhibitor. To the container is added water so that the 450 ml can is approximately 40% full of liquid. CO<sub>2</sub> is added to increase the pressure to approximately 100 psi.

#### Example 1b

The same formulation described in example 1a is prepared, but instead 20% by weight of DME is added.

#### Example 1c

2% each of two different pyrethroid insecticides selected from resmethrin, bioresmethrin, d-phenothrin and

permethrin (cis/trans ratio 25/75) are added to a 150 ml monoblock can. A sufficient amount of a mixture of methylated spirits and water is added until the volume comprises about 40% of the can. CO<sub>2</sub> is charged into the container to a pressure of at least 60 psi, and preferably 100 psi.

#### Example 2

An aerosol formulation is prepared comprising 2% by weight of d-phenothrin (trade name "Sumithrin") and 2% permethrin (25/75 cis/trans ratio). The active ingredients are dissolved in a solvent consisting of deodorised kerosene (trade name "EXXSOL D80"). The solvent constitutes about 8% by weight of the formulation. The dispensing container is then charged with propellant comprising CF<sub>3</sub>CH<sub>2</sub>F (134a) to a pressure of about 80 psi. If desired, a corrosion lining can be incorporated in the dispensing container, to assist with preventing leaks. This aerosol is ideal for use in cargo and baggage holds of aircraft.

#### Example 3

An aerosol formulation is prepared comprising 2% by weight of permethrin (25:75 cis/trans ratio). The active ingredient is dissolved in a solvent consisting of isoparaffins "Isopar". The solvent constitutes about 10% by weight of the formulation. The dispensing container is then charged with propellant comprising CF<sub>3</sub>CH<sub>2</sub>F (134a) to a pressure of about 80 psi. If desired, a corrosion lining can be incorporated in the dispensing container, to assist with preventing leaks. This formulation is ideal for spraying in passenger cabins of aircraft.

#### Example 4

Further aerosol formulations were prepared in a similar manner to that described in Example 3, but as the active pesticidal ingredients were used the following:

<u>Formulations</u>	<u>Active ingredient</u>	<u>amount (by weight)</u>
(a)	resmethrin	2%
(b)	bioresmethrin	2%
(c)	d-phenothrin	2%

These three formulations are particularly suited for use in aircraft passenger cabins, due to the lower concentrations of pesticide present.

#### Example 5

A preferred composition according to the invention was tested using the following procedure. Trials were conducted on domestic legs of a British Airways B747-400s aircraft on a return flight between Sydney and Brisbane. Ten rust red flour beetles (Tribolium castaneum) were placed in plastic cups in which the base had been removed and replaced with insect secure mesh. The cups were placed in wire retainers at various positions in the forward and afterward (aft) holds. Since the cups were open at the top and had a mesh base, air movement past the beetles was relatively unimpeded. Insects were also held in sealed cups inside plastic bags to ensure that extraneous factors were not the cause of the observed insect reaction (controls). The cages were installed before the cargo was loaded and retrieved after the flight which had a duration of about 75 minutes. An attempt was made to maintain the same cage on both flights but loading constraints limited the extent to which this was possible. The cage positions in the forward and afterwards holds on the flights were distributed evenly.

To assess the deposition of insecticide on hold surfaces four 'flats' consisting of masonite wrapped in foil (150x150mm) were placed on the floor of the forward cargo hold on a diagonal from the cargo door to the opposite corner on the flight from Brisbane to Sydney. After the flight ten flour beetles were confined on the surface of the foil for 15 minutes and then held for observation in a clean container.

Exposed and control insects were examined under a binocular microscope and their condition rated 2 hours after the Brisbane flight and 24 hours after the Sydney flight. Insects were classified as being unaffected (upright with coordinated movement) or knocked down (on their backs) with little, or active, reflex depending on the movement of their antennae and legs. Activity was classified as mixed where some individuals were relatively active while others were almost dead.

On each flight 300 g of the aerosol containing the HFC 134a propellant was sprayed manually into each hold at the position of the cargo module adjacent to the cargo hold door just prior to the door being closed. The formulation contained 2.0% d-phenothrin and 2.0% permethrin as the active ingredient, as described in Example 2, above.

On both flights the hold was not fully loaded, estimated as about 50-60% and more than 40% of capacity on the Sydney/Brisbane and Brisbane/Sydney flights respectively.

Considering the Sydney/Brisbane flight all beetles that were exposed to the spray were "knockdown" indicating that the spray had distributed through the hold at a sufficient concentration to immobilise all exposed beetles. Most of the exposed insects had little reflex activity except in the aft hold where individuals most distant or partially screened from the release point of the spray were more active. Previous experience in assessing disinsection aerosol formulations have shown that the upper positions in the corner of the holds are the most difficult to achieve an acceptable level of treatment because distributions to these areas is dependent on characteristics of the formulation such as aerosol throw, droplet, size distribution and air movement within the holds. Insects exposed below the false floor are normally the most affected because of increased exposure through air movement below the floor of sedimented aerosol as it is exhausted through the rear of the aircraft.

Results from other disinsection studies using Freon 11 and 12 as propellants indicate that the mean droplet diameter is about 4 micron and a significant proportion of the particles (less than 50%) remain in suspension for 5-6 minutes.

Visual examination of the aerosol particles produced by HFC 134a in still air and a strong light source suggests that they could have similar properties and these would be important in achieving the results obtained in these trials. Because the air-conditioner units are not activated until engine start-up there is ample time for the aerosol particles to be moved within the hold before they were relatively quickly removed by the exhausting of air below the false floor.

On the Brisbane/Sydney flight all caged insects were affected and 24 hours after the flight many of the insects had died. Results from previous trials using Tribolium castaneum have shown that if individuals are knockdown after 24 hours they do not subsequently recover but it could take several days before all insects die.

The results from the foil flats indicated that sufficient insecticide could be deposited on surfaces to immobilise and eventually kill insects which might alight on them during flight. Only two insects exposed on each of the two most distant flats from the spray point remained unaffected after 24 hours.

The residual insecticide effect of the formulation is an important component in the overall effectiveness of the formulation as it forms an insecticidal active surface to which insects, which were not immobilised by the initial spray, would be exposed during the flight.

There were no adverse reactions observed among any of the beetles exposed as controls on both flights.

Since Tribolium castaneum is hard bodied and tolerant to adverse environmental conditions and insecticides the results obtained in these trials are considered to demonstrate a high level of effectiveness for control of hard and soft bodied insects in aircraft holds. The results obtained in these trials using HFC 134a as the propellant is similar to that obtained in earlier trials for prior art CFC formulations.

Observations made during spraying indicated that the aerosol throw was about 5 metres with a discharge rate of 1 g/s which visually produced small sized aerosol particles. While the throw was inadequate to reach the corners of the hold, the results indicate that air movement within the holds was sufficient to reach insects near the ceiling in the corners of the hold.

Because the aerosols were discharged by groundcrew before departure, under right time constraints, there is an operational advantage in reducing the time required to treat the holds. The currently used formulation discharges at a rate of 4 g/s and it is preferred that the HCF 134a formulation should be discharged at a similar rate.

These trials indicate the potential of HCF 134a to act as a propellant to replace Freon 11 and 12 in formulations used for insect control in aircraft.

The formulations above were tested, and found to be satisfactory for use in aircraft, and for treating the cargo hold and passenger cabin on aircraft. Suitable dispensing means are required in order to ensure that the aerosol containing the active ingredients is in accordance with WHO standards, but a selection of the dispensing means is simple and does not require any special inventive effort.

The claims

1. An aerosol insecticidal composition suitable for use on an aircraft, which comprises a dispensing container having aerosol dispensing means, and containing an insecticidal active ingredient, and optionally a solvent for the active ingredient, and a propellant gas at sufficient pressure to dispense the active ingredient from the dispensing means as an aerosol, characterised in that the propellant is chosen from any one or more of  $\text{CF}_3\text{CH}_2\text{F}$ , DME,  $\text{CO}_2$ , or  $\text{NO}_2$  and the solvent (if present) is chosen from any one or more of hydrocarbon, alcohol or water.
2. The aerosol insecticidal composition according to claim 1 wherein the propellant is  $\text{CF}_3\text{CH}_2\text{F}$  and the solvent is a paraffinic hydrocarbon.
3. The aerosol insecticidal composition according to claim 2 wherein the propellant is 134a, and the solvent is kerosene, isoparaffin, normal paraffin, and/or white spirit in an amount of less than 12% by weight.
4. The aerosol insecticidal composition according to claim 1, wherein the active ingredient is selected from d-phenothrin and/or permethrin.
5. The aerosol insecticidal composition according to claim 1 which has the following composition:

phenothrin 20:80	2% by weight
permethrin 25:75	2% by weight
petroleum solvent	8% by weight
propellant - HFC 134a	88% by weight

6. The aerosol insecticidal composition according to claim 1, which has the following composition:

d-phenothrin, or permethrin	2% by weight
petroleum solvent	10% by weight
propellant - HFC 134a	88% by weight

7. A method of de-insecting aircraft which comprises spraying the cargo holds and/or passenger compartments with an aerosol insecticidal composition according to any one of claims 1 to 6 immediately before departure and/or before arrival of said aircraft at an airport.



## AMENDED CLAIMS

[received by the International Bureau on 17 December 1993 (17.12.93); original claims 1,2,8 and 9 amended; new claims 4,11,15 and 16 added; remaining claims unchanged but renumbered. (3 pages)]

1. (Amended) An aerosol insecticidal composition suitable for use on an aircraft, which comprises an insecticidal active ingredient, and optionally a solvent for the active ingredient in an amount of 0 to 12% by weight, and a propellant gas sufficient to dispense the active ingredient from a dispensing means as an aerosol, characterized in that the propellant consists essentially of  $\text{CF}_3\text{CH}_2\text{F}$  (HFC 134a).
2. (Amended) The aerosol insecticidal composition according to claim 1 wherein the propellant is  $\text{CF}_3\text{CH}_2\text{F}$  and solvent is present and is a paraffinic hydrocarbon in an amount of 8 to 10% by weight.
3. The aerosol insecticidal composition according to claim 2 wherein the solvent is kerosene, isoparaffin, normal paraffin, and/or white spirit.
4. (New) The aerosol insecticidal composition according to claim 1, wherein the active ingredient comprises at least one pyrethroid.
5. The aerosol insecticidal composition according to claim 4, wherein said pyrethroid is selected from d-phenothrin and/or permethrin.
6. The aerosol insecticidal composition according to claim 1 which has the following composition:

phenothrin 20:80	2% by weight
permethrin 25:75	2% by weight
petroleum solvent	8% by weight
propellant - HFC 134a	88% by weight

7. The aerosol insecticidal composition according to claim 1 which has the following composition:

d-phenothrin, or permethrin	2% by weight
petroleum solvent	10% by weight
propellant - HFC 134a	88% by weight

8. (Amended) A method of de-insecting aircraft which comprises spraying the cargo holds and/or passenger compartments with an aerosol insecticidal composition characterized in that said aerosol insecticidal composition comprises an insecticidal active ingredient, and optionally a solvent for the active ingredient in an amount of 0 to 12% by weight, and a propellant gas sufficient to dispense the active ingredient from a dispensing means as an aerosol, and further characterized in that the propellant consists essentially of  $\text{CF}_3\text{CH}_2\text{F}$  (HFC 134a).

9. (Amended) The method according to claim 8 wherein the propellant is  $\text{CF}_3\text{CH}_2\text{F}$  and solvent is present and is a paraffinic hydrocarbon in an amount from 8 to 10% by weight.

10. The method according to claim 9 wherein the solvent is kerosene, isoparaffin, normal paraffin, and/or white spirit.

11. (New) The method according to claim 8 wherein the active ingredient comprises at least one pyrethroid.

12. The method according to claim 11 wherein said pyrethroid is selected from d-phenothrin and/or permethrin.

13. The method according to claim 7 wherein the aerosol insecticidal composition is as follows:

d-phenothrin, or permethrin	2% by weight
petroleum solvent	10% by weight
propellant - HFC 134a	88% by weight

14. The method according to claim 7 wherein the aerosol insecticidal composition is as follows:


d-phenothrin, or permethrin	2% by weight
petroleum solvent	10% by weight
propellant - HFC 134a	88% by weight

15. (New) A method according to claim 8 wherein the insecticidal composition is sprayed immediately before departure and/or before arrival of said aircraft at an airport.
16. (New) A method according to claim 8 wherein the insecticidal composition acts as a residual insecticide which after application retains insecticidal activity over an extended time period.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 93/00393

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int. Cl. <sup>5</sup> A01N 25/06, A01N 53/00, C09K 3/30  According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>  Minimum documentation searched (classification system followed by classification symbols) A01N 25/06, C09K 3/30  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU:IPC as above, Australian Classification 87. 18. 42. 2  Electronic data base consulted during the international search (name of data base, and where practicable, search terms used) DERWENT: A01N 25/06, C09K 3/30 + 'Insectide' JOPAL: A01N 25/06, C09K 3/30 CHEM ABSTRACTS				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.		
X	DE 2737132 (Daikin Kogyo CO) 17 August 1978 (17.08.78)	1-7		
X,Y	AU-B 71206/91 (638100) (ATOCHEM) 22 August 1991 (22.08.91)	1,2		
Y	US 4851595 (EI DuPont de Nemours) 25 July 1989 (25.07.89)	1,2		
Y	US 4129603 (ICI) 12 December 1978 (12.12.78) page 3	1,2		
P	WO 93/09199 (EI DuPont de Nemours) 13 May 1993 (13.05.93), page 18	1,2		
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.         </div> <div style="text-align: center;"> <input type="checkbox"/> See patent family annex.         </div> </div>				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;">           * Special categories of cited documents :            "A" document defining the general state of the art which is not considered to be of particular relevance            "E" earlier document but published on or after the international filing date            "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)            "O" document referring to an oral disclosure, use, exhibition or other means            "P" document published prior to the international filing date but later than the priority date claimed         </td> <td style="width: 50%; vertical-align: top;">           "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention            "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone            "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art            "&amp;" document member of the same patent family         </td> </tr> </table>			* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search 1 November 1993 (01.11.93)		Date of mailing of the international search report 11 NOV 1993 (11.11.93)		
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA  Facsimile No. 06 2853929		Authorized officer  <div style="text-align: center;">   <b>C.A. BRICK</b>          Telephone No. (06) 2832453       </div>		

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 93/00393

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
Y,A	M. JOHNSEN, "The Aerosol Handbook", 2 ed., published 1982 by Wayne Dorland Co (New Jersey), pages 305-372, especially pages 321, 354-366	1-7
Y	"The Merck Index", 10 ed., published 1983, by Merck & Co (USA) (ed. Martha Windholz), pages 1032 and 1046	1-7
X	Derwent Abstract Accession No. 84-142657/23, Class C03, JP, A, 9073-502 (Famakila) 25 April 1984 (25.04.84)	1
X	Patent Abstracts of Japan, C-103, page 120, JP,A, 57-18776 (Sunstar Hamigaki) 30 January 1982 (30.01.82)	1
X	Patent Abstracts of Japan, C-649, page 15, JP,A, 63-13997 (Dainippon Jochugiku Co) 31 July 1989 (31.07.89)	1
X	Patent Abstracts of Japan, C-752, page 127, JP,A, 2-149504 (Earthchem Co) 8 June 1990 (08.06.90)	1
X	Patent Abstracts of Japan, C-794, page 64, JP,Am 2-258702 (Sumitomo Chem Co.) 19 October 1990 (19.10.90) and	1
&	Chemical Abstracts, Vol.115, 1991, Columbus, Ohio, US; Abstract No. 3185t	1
X	GB 2213725 (Sumitomo Chemical Co) 23 August 1989 (23.08.89) claim 1	1
X	GB 2213726 (Sumitomo Chemical Co) 23 August 1989 (23.08.89) claim 1	1
	Please Note: Due to the excessive number of documents which disclose an aerosol insecticide composition comprising a pyrethrum compound with CO <sub>2</sub> or DME as a propellant, only a few representative citations have been included.	

**Box I** Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II** Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Information on patent family members

PCT/AU 93/00393

[illegible]